1 WACC

1.1 Introduction

A business raises funds from its investors (both equity and debt investors) and uses those funds to try to generate returns. These investors are therefore taking a RISK by trusting that the business will spend their money wisely. Consequently, investors require a return to compensate them for taking this risk. This is what we call the “investors' required return” or if just looking at the shareholders’ position the “shareholders’ required return”.

This required return should be viewed as the MINIMUM return that a business should look to generate from projects if it is to add value to investors. Consider a simple example from your everyday lives. If you borrow money from a bank at an interest rate of 8% and use that money to buy some investments that only generate you a 6% return you will be out of pocket!

A Financial Manager will need to be able to estimate what return the company’s investors want overall so they can judge whether the project they are looking into is going to offer a sufficiently high return to add value to the shareholders.

The Financial Manager will actually be concerned with what the overall cost of the finance to the company is after taking into account any tax relief available on the finance source (i.e. tax relief on interest). This is then known as the weighted average cost of capital, WACC to the business if there is more than one finance source.

ILLUSTRATION 1.1: OVERALL INVESTORS’ REQUIRED RETURN

TP has $200m of finance from investors in total, consisting of 60% ($120m) equity and 40% ($80m) debt. The equity investors’ required return is 10% whereas the debt investors only require a return of 5% since their risk is lower (e.g. the debt is secured).

Estimate the overall average investors’ required return and hence the WACC (ignore taxation).

SOLUTION

The overall average cost of TP’s capital can be found by taking a simple weighted average of the costs of the two sources as follows:

\[
\text{WACC} = (0.10 \times 0.60) + (0.05 \times 0.40) = 8\%
\]

This cost of capital can then be used as the discount rate (hurdle rate) for appraising potential projects using NPV analysis.

The main purpose of the section that follows is to demonstrate how the above calculation can be performed in more complex scenarios where you may have to calculate the cost of capital to a company. The following formula is given in the exam for this purpose but basically just does what we did above to get to 8%. Sometimes this is referred to as the “traditional WACC formula”.

\[
\text{WACC} = k_{eq} \left( \frac{\text{V}_E}{\text{V}_{eq} + \text{V}_D} \right) + k_d(1 - t) \left( \frac{\text{V}_D}{\text{V}_{eq} + \text{V}_D} \right)
\]

Where,

- \( k_{eq} \) = cost of equity in a geared company
- \( k_d \) = cost of debt (after tax)
- \( \text{V}_E \) = market value of equity
- \( \text{V}_D \) = market value of debt

It is acceptable to use the book value (statement of financial position value) of debt and equity if there is insufficient information in the question to be able to estimate the market value.
Note

If a company has more than two sources of finance (quite likely in practice) and each has a separate cost then the above formula would be extended. For example, if there were preference shares as well the formula would become:

\[
WACC = k_{eg} \left[ \frac{V_E}{V_E + V_D + V_P} \right] + k_d \left[ 1 - t \right] \left[ \frac{V_D}{V_E + V_D + V_P} \right] + k_p \left[ \frac{V_P}{V_E + V_D + V_P} \right]
\]

\[\text{EXAMPLE 1.1: WACC}\]

It is currently 1\textsuperscript{st} Feb 2016 and SCS Co is financed with a mixture of equity and debt. It has just paid a dividend of 45 cents on its 4.5 million ordinary shares which have a market value of $5.25. The constant dividend growth rate is 6%. The 7% redeemable debt currently has a market value of 97% cum-interest and is due to be redeemed at par on 31\textsuperscript{st} Jan 2020. The after tax cost to the company of this redeemable debt has correctly been calculated as 7.9%. The corporation tax rate is 30%. An extract from SCS’s statement of financial position shows the following.

\[
\begin{array}{ll}
\text{Debt} & 10,000,000 \\
\text{Shareholders’ funds} & 19,450,000 \\
\end{array}
\]

What is the WACC for SCS Co?

\[\text{SOLUTION}\]

\[\text{Step 1 - If we first consider the cost and market value of the ordinary shares}\]

\[\text{Step 2 – Now consider the cost and market value of the debt}\]

\[\text{Step 3 – Work out the WACC}\]
1.1.2 Uses of the WACC

The WACC can be used as the hurdle rate (cost of capital/discount rate) for appraising future projects (subject to the conditions below). A project that offers a return that is higher than the WACC is worth doing (i.e. positive NPV) since it generates an amount in excess of that which would be necessary to repay the finance providers.

Conditions for use of the WACC

Using the WACC as the hurdle rate for future investments requires the risks of the future investments to be identical to those facing the existing business. If there are changes to risk likely, then the current WACC is unlikely to be suitable to use. The two main risks to deal with at F3 are

- **business risk** (risk due to the type of industry you are operating in) and
- **financial risk** (risk due to your gearing/capital structure).

You may also need to consider the size of the new investment. Even if the new investment does have the same business risk and financial risk to current operations, if it is large in size relative to the existing business then it may affect the risk profile such that WACC may need to be reconsidered.

<table>
<thead>
<tr>
<th>What if there is a change in...</th>
<th>What to do?</th>
</tr>
</thead>
<tbody>
<tr>
<td>Business Risk</td>
<td>Need to identify the risk associated with the new industry you are going to invest in. This is typically done by finding a relevant beta factor for that industry and using the beta to help identify a project specific cost of capital to appraise the investment at.</td>
</tr>
<tr>
<td>Financial Risk</td>
<td>Since changing the debt and equity mix will affect $V_E$ and $V_D$ in the WACC formula and also will be likely to impact investors required returns ($k_{eq}$) it is important to be able to consider the overall effect on WACC. There are some basic theories (Traditional theory and Modigliani &amp; Miller theories) that you need a working knowledge of for F3. In order to appraise a new project that will lead to a change in the overall capital structure it would be appropriate to use the ADJUSTED PRESENT VALUE (APV) technique. This is outside the scope of the F3 syllabus.</td>
</tr>
</tbody>
</table>

**Note**

If a project is being financed with a specific source of finance (e.g. a bank loan), then the exam question might suggest using the cost of the bank loan as the discount rate to appraise the project. This is wrong since it ignores the impact that the project and the loan are having on the other finance providers (particularly the shareholders).

Projects generally should be considered to be financed out of the overall pool of funds that the company has and so a WACC is likely to be a more appropriate discount rate as this considers returns required to all finance providers.
2 Capital Structure

You may be required to estimate a relevant cost of capital (cost of equity or WACC) for a business valuation and consequently might need to identify risk levels in relation to a business you are trying to value.

2.1 Portfolios and business risk

A rational investor should build an efficient portfolio by not putting all their eggs in one basket! (they should try to find investments that are not well correlated with one another). In other words investors should DIVERSIFY in order to reduce risk.

By diversifying the investor is able to largely eliminate what is known as UNSYSTEMATIC RISK (that is the risk specific to individual companies caused by their management structure, technology, susceptibility to changing weather etc...).

Once the investor has diversified as much as they can they will have a portfolio of investments that is only susceptible to SYSTEMATIC RISK (that is risk due to general market factors such as changes to interest rates, exchange rates, productivity levels etc).

The systematic risk of an individual investment (ie the extent to which an individual investments returns are affected by these general market factors) is measured by a BETA FACTOR. In reality these are calculated by looking at the change in the return on an individual share (dividends and share price increases) as the stock market moves by 1%.

A beta factor for an individual investment or project gets inserted into the CAPM formula to give a measure of the investors required return to compensate them for systematic risk only (ie assuming they are already fully diversified).
As you have seen the β factor is the measure of risk facing the investor which when put into the CAPM indicates the required return of that investor (i.e. for equity investors this is $K_e$).

If you already have a diversified portfolio of investments or are a company with diversified shareholders you can estimate the beta factor for the portfolio/company by working out a weighted average beta based on what proportion of the portfolio/company each investment makes up. This is shown in the following illustration.

ILLUSTRATION 2.1: PORTFOLIO RISK AND RETURN

Steve currently has a diversified portfolio of investments worth $60,000 with an overall β of 1.3. He is considering investing a further $40,000 in Wacky, a company with a current β of 1.5. The risk free rate is currently 6% and the return on the market is 14%.

Estimate the risk and required return of the new portfolio including Wacky.

SOLUTION

Since Steve is a diversified investor the estimated risk of the portfolio can be calculated by simply using a weighted average of the β factors within the overall portfolio.

Steve will have a total investment of $100,000 of which 60% comes from his existing portfolio and 40% would be Wacky.

\[ \text{Risk(β) of new portfolio} = (0.6 \times 1.3) + (0.4 \times 1.5) = 1.38 \]

The required return can then be calculated by using this new β in the CAPM.

\[ k_e (\text{required return}) = R_f + [R_m - R_f] \beta = 6\% + [14\% - 6\%] 1.38 = 17.04\% \]

2.2 Impact of debt on β factors and $k_e$

The risk facing a shareholder will partly depend on the nature of the business that they are investing in (business risk) as well as the amount of debt (gearing) that the company has (financial risk). It can be demonstrated that the risk facing the shareholder increases as the level of gearing increases since the volatility of potential equity returns increases.

<table>
<thead>
<tr>
<th>EBIT</th>
<th>Yr 1</th>
<th>Change</th>
<th>Yr 2</th>
<th>Change</th>
<th>Yr 1</th>
<th>Change</th>
<th>Yr 2</th>
</tr>
</thead>
<tbody>
<tr>
<td>EBIT</td>
<td>100,000</td>
<td>↓40%</td>
<td>60,000</td>
<td></td>
<td>100,000</td>
<td>↓40%</td>
<td>60,000</td>
</tr>
<tr>
<td>Interest</td>
<td>-</td>
<td></td>
<td>-</td>
<td></td>
<td>(20,000)</td>
<td></td>
<td>(20,000)</td>
</tr>
<tr>
<td>EBT</td>
<td>100,000</td>
<td></td>
<td>60,000</td>
<td></td>
<td>80,000</td>
<td></td>
<td>40,000</td>
</tr>
</tbody>
</table>
The simple illustration shows that a company with debt (Geared Co) has potential dividends that are more volatile than the company with no debt (Ungear Co). This occurs because the interest payments are fixed regardless of operating performance.

The conclusion is that,

**Risk facing shareholders in geared co > Risk facing shareholders in ungeared co**

∴ \( \beta \) for geared co \( \beta_g \) > \( \beta \) for ungeared co \( \beta_u \)

∴ cost of equity in geared co \( k_{eg} \) > cost of equity in ungeared co \( k_{eu} \)

**Note on terminology**

You may sometimes see a **geared \( \beta \) called an equity \( \beta \) and an ungeared \( \beta \) called an asset \( \beta \).**

To help visualise this consider the following diagram.

---

**Cost of capital**

\[ k_{eu} \]  
\[ k_{eg} \]

\[ \beta_u \] into the CAPM formula gives

\[ \beta_g \] into the CAPM formula gives (for the relevant gearing ratio)

\[ k_{eg} = k_{eu} + [k_{eu} - k_d] \frac{V_d(1-t)}{V_e} \]

Note that \( k_d \) refers to a debt beta. Debt betas are normally assumed to be zero (unless told otherwise in a question). If a debt beta is zero it simply means that the company can be assumed to be able to borrow at the risk free rate.
ILLUSTRATION 2.2: BETA FACTORS

PBB is considering an investment in the mobile phone market, a market that is different to its current operations. PBB is an all equity funded business and wishes to remain so.

Phones5Me is a listed mobile phone business with a published beta (this will be a geared beta) of 1.6 and an existing gearing ratio \( \frac{D}{D+E} \) of 25%.

What cost of capital would it be appropriate for PBB to use in order to appraise this investment if the risk free rate is 5% and the return on the market is 12%?

Taxation is at 30% and assume all corporate debt is risk free (i.e. debt beta is zero).

SOLUTION

Typically we would need to find a WACC, however be careful here since PBB is an all equity funded business it will not have any debt and hence the WACC = Cost of equity ungeared = \( K_{eu} \).

\[ \therefore \] we will need to find the ungeared cost of equity.

There are always two ways of finding the cost of equity, DGM or CAPM. Here we have no dividend information but we do have beta factors so we can safely assume the CAPM is required.

To use the CAPM we will need a beta factor that reflects the business risk of the mobile phone market but with PBB’s financial risk (i.e. with no debt hence no financial risk). Therefore we need an ungeared beta. We are given a geared beta for Phones5Me and we will need to “ungear” this.

\[
\beta_u = \beta_g \left[ \frac{V_e}{V_e + V_d (1-t)} \right]
\]

\[
\beta_u = 1.6 \left[ \frac{75}{75 + 25(0.7)} \right] = 1.6 \left[ \frac{75}{92.5} \right] = 1.297
\]

We now need to put this beta factor into the CAPM to find \( k_{eu} \)

\[
k_e = R_f + (R_m - R_f)\beta
\]

\[
k_{eu} = 5\% + (12\% - 5\%)1.297 = 14.08\%
\]

LECTURE EXAMPLE 2.1: COST OF EQUITY

ED and GOR are identical businesses in all respects apart from ED being financed entirely by equity and GOR having a debt:equity ratio of 1:2. ED’s cost of equity is 14% and GOR’s pre-tax cost of debt is 10%. Tax is payable at 25%.

What is GOR’s cost of equity?

SOLUTION
The board of MN, an unlisted company, needs to derive its cost of equity so that it can carry out a valuation of the company. The board is aware that the expected return on the market portfolio is 12% and the current return on a risk-free asset is 5%. The tax rate is 30%.

A similar listed company in the same industry sector to MN has an equity beta of 1.62 and a debt-equity ratio of 1:2. MN’s debt-equity ratio is 1:5. Debt can be assumed to be risk-free.

Calculate MN’s cost of equity to the nearest 0.01%.

SOLUTION

2.3 Impact of debt on WACC

When debt is introduced into a business’ financial structure there are two major factors, already highlighted in these notes, which will influence the WACC.

These are:

- **Increase the level of debt**
  - Debt is cheaper than equity (less risk to the investor).
  - Shareholders financial risk increases (↑ Ke).
  - WACC ↓
  - WACC ↑
  - ?
  - Suggests it would be a good idea to use less debt
  - Suggests it would be a good idea to use more debt

The question is which one of the two factors dominates (i.e. does the WACC actually go up or down when the level of debt rises)?

The answer is that it depends on which theory you believe. The F3 syllabus requires a basic awareness of the following theories;

- Traditional theory
- Modigliani & Miller (no tax)
- Modigliani & Miller (with tax)
One fundamental point about the theories is that they agree that lower the WACC is, the higher the NPV of projects is and hence the higher the market value of the business is (MV of business being the MVdebt + MVequity). This is because if you discount the operating cash flows of a business at a lower WACC then the PV of those cash flows will be higher.

2.3.1 Traditional theory

Adding debt makes sense up to a certain gearing level since it is cheaper and shareholders’ risks aren’t initially significantly affected. Eventually, if gearing gets too high the cost of debt and equity will rise such that WACC eventually starts to rise.

Conclusion – There is an optimum WACC (lowest point) where project and hence company value will be maximised.

2.3.2 M&M (No TAX) – 1958 proposition

As the level of debt increases the benefits of debt (cheaper than equity) is exactly offset by the fact that the cost of equity ($k_{eq}$) increases, such that overall the WACC remains constant. The two forces above are therefore equal and opposite.

Conclusion – WACC is not affected by gearing.

Financing has no impact on company value.
2.3.3 M&M (With TAX) – 1963 proposition

There is now an added benefit to using debt since it is made even cheaper due to the tax relief on the interest payments. The lower cost of debt outweighs the increasing $k_{eg}$ such that WACC falls as gearing increases.

Conclusion – WACC reduces as debt levels ↑. Therefore use as much debt as possible! The following formulae can be linked to this MM theory

\[
\begin{align*}
WACC &= k_{eu}(1 - \left[ \frac{V_p t}{V_e + V_D} \right])
\end{align*}
\]

\[
\begin{align*}
k_{eg} &= k_{eu} + \left[(k_{eu} - k_d) \left( \frac{V_D [1-t]}{V_e} \right) \right]
\end{align*}
\]

Value of a company

\[
\begin{align*}
V_g &= V_u + TB
\end{align*}
\]
M&M make a few fairly limiting assumptions including:

- Debt is always risk free (big assumption) and hence the cost of debt remains at the risk free rate regardless of the level of gearing.
- Perfect capital markets (perfect information, rational risk averse investors and no transaction costs).
- Individuals and companies can borrow and invest at the same rate.
- Investors are indifferent between personal and corporate gearing. In other words investors do not mind whether they invest in a company that has some debt or they borrow money personally to invest in an all equity funded business.

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**Lecture Example 2.3: WACC and Betas**

Green Man operates in the wallpaper design industry, where most of the customers are large hotels. The Managing Director has identified an opportunity to diversify into the manufacturing of cranes for the construction industry by buying a Crane manufacturer, Dweeb Ltd, that has the same level of gearing as Green Man currently has.

Green Man’s gearing is currently represented by a D:E ratio of 2:5.

Green Man currently has a WACC of 14% and a published beta of 1.1. Nacre is a listed crane manufacturer with a beta factor of 1.8 and a D:E ratio of 3:4. The average stock market return over recent years has been 10% and the risk free rate is 4%.

Assuming that both Green Man, Dweeb Ltd and Nacre can borrow at the risk free rate (i.e. the $\beta_d = 0$) what would be a suitable WACC for Green Man to use when valuing Dweeb Ltd. The tax rate is 30%.

**SOLUTION**